Celebrating WNY

Lesson – *Music in Nature: Exploring Pitch & Intonation through the Science of Vibration*

Companion Video – "Pure Note" from *Whistler Waves*

Suggested Grade Level

Grades 3-5

Objective

Students will listen to Movement I: "Pure Note" from Caroline Mallonee's *Whistler Waves* and understand how vibration relates to the science of sound. Students will explore how the vibrations from a string instrument create various pitches and develop intonation. Students will relate the physics of sound and instrument vibrations to the expressive qualities in a piece of music.

Suggested Materials

- BPO video of Movement I: "Pure Note" from Caroline Mallonee's *Whistler Waves*
- Sound clip of NASA Whistler Waves https://tinyurl.com/y5nvcp6u
- Mp3 example of Pure Note Whistlers https://tinyurl.com/y8a5u5av
- Vocabulary list (provided)

New York State Arts Standards

MU:Re7.1.3a-5a
MU:Re7.2.3a-5a
MU:Re8.1.3a-5a

New York State English Language Arts & Literacy Standards

Speaking & Listening, Standard 1, 2 & 3
Language, Standard 1, 3 & 6

New York State Science Standards

P-PS4-1
1-PS4-1

Procedure

1) Musical talent can be found all throughout Western New York! Caroline Mallonee is an award-winning composer and performer based in Buffalo. Her concerto, *Whistler Waves,* was written for BPO cellist, Feng Hew. The composer wanted to create a piece that sounded like *whistler waves* in nature. Whistler waves are audible frequencies in

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the atmosphere after a bolt of lightning. There are four types of whistler waves, and the four movements of the concerto correspond to these.

2) Have students listen to the recording of Movement I: "Pure Note" from *Whistler Waves.* After they listen, ask students what sounds they heard in the cello part. What did the music remind them of? What sounds in nature can be compared to the music they heard?
3) Introduce the scientific phenomenon of whistler waves to students. A **whistler** is an audible low frequency wave in the atmosphere generated by a lightning strike. A whistler is detected as a gliding high-to-low frequency sound repeated at regular intervals of several seconds, or a descending musical tone. A **Pure Note Whistler** results from higher frequencies arriving to the atmosphere first, followed by lower ones, which results in a clear whistling sound.
4) Play the NASA audio clip of whistler waves and pure note whistler wave clip for students.
5) Go over the vocabulary list with students and explain each scientific concept and how it relates to music:

   Pitch is the quality of sound, or the degree of highness or lowness, based on the rate of vibrations producing it. **Intonation** is the variation of pitch.

   Frequency is the speed of **vibration**, which determines the pitch of the sound. Explain to students that higher frequencies produce higher sounds, while lower frequencies result in a lower pitch, or sound. Demonstrate this concept by whistling. Explain that when you produce more air, or increase the speed of your air by tightening your lips, sound wave frequency increases (more waves), producing a higher sound. When less air is used, frequency decreases, which produces a lower sound. Have students try whistling themselves and experiment with changing the pitch.
      a) If whistling is a struggle for some students, this concept can also be demonstrated by using a Whirly Tube instrument. The faster the tube is whirled, the higher the sound.
6) Pitch is also affected by the **wavelength** of sound- the size of the sound wave. Lower notes have longer wavelengths (waves are more spread out), while higher notes have shorter wavelengths (waves are closer together). That is why pressing down on the strings of a cello will raise the pitch, as you are shortening the length of the string that is free to vibrate.
      a) Demonstrate this concept for students on a string instrument.
      b) This concept can also be demonstrated using a slide whistle or trombone. Lengthening the air column, or pulling the slide out more, will produce a lower sound, while drawing the slide in shortens the air column (wavelength), producing a higher sound.
7) Have students listen to the recording of Movement I: "Pure Note" from *Whistler Waves* a second time and have them focus on the similarities and differences they hear in the music versus the whistler waves sound in nature. How is the solo cello part imitating a whistler wave? What musical techniques are used to create the whistler effect? Have

students raise their hand, or notate the time stamp in the recording, during the parts where they hear the whistler wave sound imitated.

Vocabulary List:

Vibration: movement that creates a sound

Frequency: the speed of vibration, which determines the pitch of the sound. It is measured as the number of wave cycles that occur in one second, or, in music, how many air vibrations reach our eardrums every second.

Wavelength: the size of a sound wave, or the distance that a wave travels before the next wave begins. Changing the wavelength of a sound wave changes the frequency, creating a new pitch.

Pitch: the quality of sound, or the degree of highness or lowness, based on the rate of vibrations producing it.

Intonation: the variation of pitch

Whistler: an audible low frequency wave in the atmosphere generated by a lightning strike. A whistler is detected as a gliding high-to-low frequency sound repeated at regular intervals of several seconds, or a descending musical tone.

Pure Note Whistler: a type of whistler wave that results from higher frequencies arriving to the atmosphere first, followed by lower ones, producing a clear whistling sound.